Takuji HOSHINO*: **Cytotypes of *Carex oxyandra* and their distribution in Japan**

星野卓二*: 日本産ヒメスゲのサイトタイプとその分布

According to Akiyama (1955), *Carex oxyandra* Kudo occurs commonly in Saghaline of the U.S.S.R. and in the northern part of Japan. In the southern part of Japan, this species is found only in restricted areas of the Shikoku and Kyushu regions. Tanaka (1939, 1948) reported aneuploidy of the chromosome number, $2n=18$ and $2n=20$, for this species from specimens collected in the Kanto region. The present paper describes two new chromosome numbers, $2n=24$ and $2n=26$, in stocks collected from the Shikoku and Kyushu regions.

This study was accomplished under the direction of Professor Dr. Ryuso Tanaka, Hiroshima University, to whom the author wishes to express his sincerest gratitude. Cordial thanks are extended to the late Dr. Kaori Okamoto for identification of the material studied. Voucher specimens of chromosomal observations were deposited in the Herbarium of the Biological Laboratory of the Okayama University of Science.

Materials and methods The series comprised 98 stocks collected from 14 localities in Japan (Table 1). Somatic chromosomes were observed in meristematic cells of the root tips. Root tips were pretreated with 0.004 M 8-hydroxyquinoline for 5 hours at 15°C. They were then fixed in a 2 : 1 : 1 mixture of absolute ethanol, chloroform and glacial acetic acid at 5°C for 1 or 2 hours, stained by Feulgen's nuclear reaction, and macerated in a mixture of 1% pectinase and 1% cellulase for 1 hour at 30°C. After maceration, they were stained in 1% aceto-orcein for 10 or 20 minutes, then squashed. Meiotic chromosomes were observed in the pollen mother cells (PMCs). Staminate spikelets were fixed in a 2:1:1 mixture of absolute ethanol, chloroform and glacial acetic acid at 5°C for over 1 hour. Anthers were then stained in 1% aceto-orcein and squashed gently.

Observations The 98 stocks investigated showed four chromosome numbers, $2n=18$, 20, 24 and 26. The $2n=18$ was found in 9 stocks collected from

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Tab. 1. Locality, chromosome number and number of stocks of *Carex oxyandra* Kudo.

Locality	Chromosome number 2n	n	No. of Stocks studied
Kirifuritoge, Tochigi Pref.	18	9	9
Myokokogen, Niigata Pref.	20	10	10
Shiobara-T., Tochigi Pref.	20	10	4
Onioshidashi, Gunma Pref.	20	10	7
Shigakogen, Nagano Pref.	20	10	4
Mt. Tengudake, Nagano Pref.	20	10	5
Shibunoyu, Nagano Pref.	20	10	3
Mt. Ontake, Nagano Pref.	20	10	13
Mt. Fuji, Yamanashi Pref.	20	—	5
Mt. Tsurugi, Tokushima Pref.	24	—	5
Mt. Nishiakaishi, Ehime Pref.	24	12	18
Mt. Sasagamine, Ehime Pref.	24	12	10
Mt. Ishizuchi, Ehime Pref.	24	—	3
Mt. Hikosan, Fukuoka Pref.	26	13	2

Kirifuritoge, Tochigi Prefecture. The 2n=18 stocks formed 9 bivalents in all PMCs and there was no irregular division in anaphase I and II. At metaphase I, two homologous chromosomes were associated with each other as end-to-end pairing. The 9 bivalents varied in size from about 4.0 μm to 1.5 μm in the major axis and were classified into the following three categories; four large, three medium and two small chromosomes (Fig. 1-A).

The 2n=20 was found in 51 stocks collected from 8 localities in Niigata, Tochigi, Gunma, Nagano and Yamanashi Prefectures. The 2n=20 stocks formed 10 bivalents in all PMCs and there was no irregular division, as in the 2n=18. The 10 bivalents varied in size from about 2.7 μm to 1.5 μm in the major axis and were classified into the following three categories: two large, five medium and three small chromosomes (Fig. 1-B).

The 2n=24 was found in 36 stocks collected from 4 localities in Tokushima and Ehime Prefectures. The 2n=24 stocks formed 12 bivalents in all PMCs and there was no irregular division, as in the 2n=18. The 12 bivalents varied in size from about 3.4 μm to 1.3 μm in the major axis and were classified into the following three categories; one large, six medium and five small chromo-

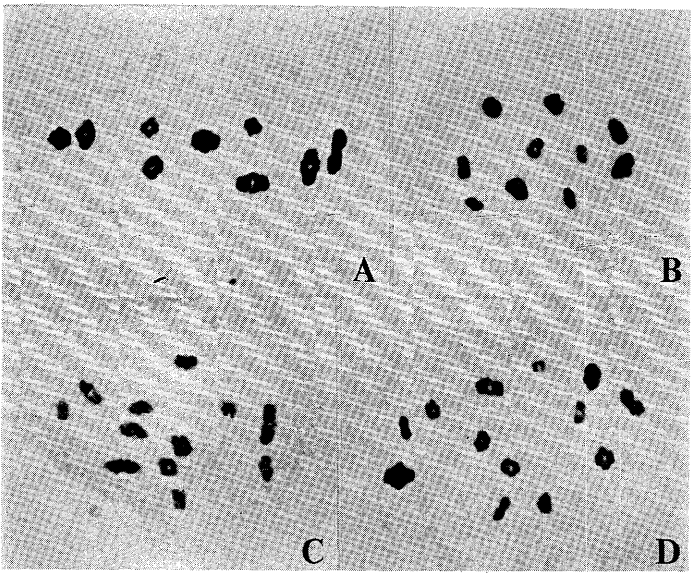

Fig. 1. Photomicrographs of chromosomes of meiotic metaphase I observed in PMCs of *Carex oxyandra*. A. n=9 of Kirifuritoge. B. n=10 of Onioshidashi. C. n=12 of Mt. Nishiakaishi. D. n=13 of Mt. Hikosan. ×1500.

somes (Fig. 1-C).

The 2n=26 was found in two stocks collected from Mt. Hikosan, Fukuoka Prefecture. The 2n=26 stocks formed 13 bivalents in all PMCs and there was no irregular division, as in the 2n=18. The 13 bivalents varied in size from about 2.7 μm to 1.0 μm in the major axis and were classified into the following four categories; one large, five medium, six small and one especially small chromosomes (Fig. 1-D).

All chromosomes of these four aneuploids were bivalent at metaphase I in PMCs. In this species, the bivalent chromosomes were classified into three; large, medium and small chromosomes. With increase in the chromosome number, the number of large chromosomes was decreased and that of small chromosomes was increased.

Discussion Tanaka (1948) reported aneuploid chromosomes numbers of 2n=18 and 2n=20 for this species, although there was no mention of the geographical distribution of these aneuploids. Hoshino and Okamoto (1979) reported that the two cytotypes of *Carex conica* Boott collected from the Chugoku and

Shikoku regions of Japan showed difference in growing conditions and geographical distribution and were genetically stable. In the present paper, four aneuploids of *C. oxyandra*, 2n=18, 2n=20, 2n=24 and 2n=26, with stable chromosome numbers and regular meiotic division in each population are reported. These aneuploids are considered to be genetically stable.

In the western part of Japan, *C. oxyandra* is geographically isolated. In the Shikoku and Kyushu regions, this species (2n=24 and 2n=26) occurs in high mountainous areas and has not been found in the Chugoku region, while in the Kanto region, 2n=18 and 2n=20 occur in areas from low to high mountains (Fig. 2). So, this species with different chromosome numbers seems to be differentiated into four cytotypes.

Devies (1956) and Faulkner (1972) reported that the cause of the aneuploid

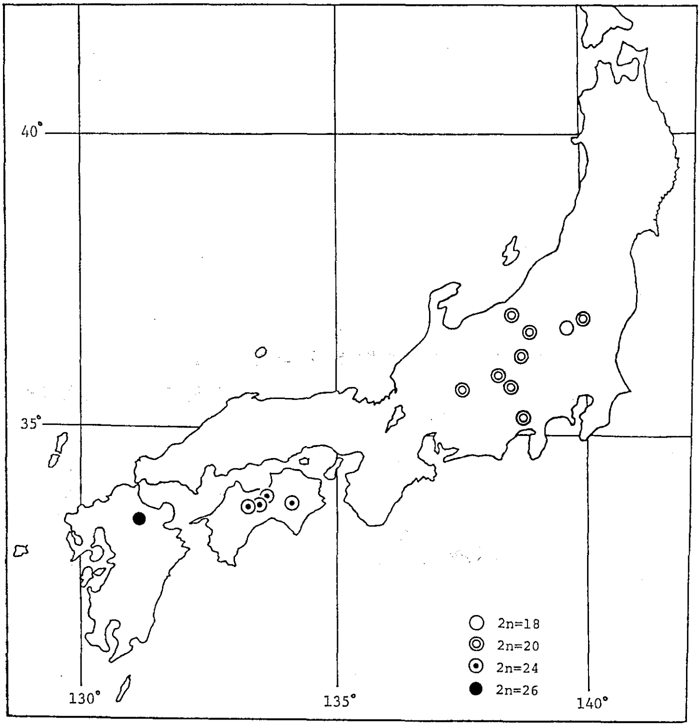

Fig. 2. Geographical distribution of four cytotypes of *Carex oxyandra* in Japan.

series in *Carex* was agmatoploidy. In the aneuploid series of *C. oxyandra*, small chromosomes were produced by agmatoploidy, supposedly through fragmentation of large or medium chromosomes. *C. oxyandra* is known as a common species in the northern regions of Japan. Therefore in *C. oxyandra* the aneuploidal increase might have resulted from the spread of the geographical distribution to the southern areas of Japan.

Literature cited

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Carex oxyandra ヒメスゲは主に樺太や日本の北方に生育しており，四国，九州地方では山地に隔離分布をしている。関東，四国，九州の14場所産98株について染色体数を観察し，次の結果を得た。関東地方産の株は $2n=18$ と $2n=20$ で，四国地方産の株は $2n=24$，九州地方産の株は $2n=26$ であった。減数分裂では観察したすべての株が正常な 2 価染色体を形成し分裂異常は見られなかった。このことから，各異数体が 3 地方でそれぞれ安定したサイトタイプとして分化していると考えられる。2 価染色体は大きさで，大型，中型，小型の 3 種類に区別された。異数体のうち，染色体数が増加したものは大型の染色体が減少し，代りに小型の染色体が増加していた。このことから，北方系の種であるヒメスゲは，地理的分布が南に拡大するにつれて染色体数が異数的に増加していることがわかった。